

1. The advertisement below is for a holistic remedy called colloidal silver. Into the late 1920s it was commonly used as an antibiotic agent. Its regular use was discontinued after the discovery of Penicillin in 1928. Today, colloidal silver can be purchased in health food store and on the internet.

ELECTRO-COLLOIDAL SILVER

Safely stops internal & external infections!

Bronchitis
Burns & Bites
Colds & Flu
Ear/Eye Infection
Food poisoning
Gonorrhea
Herpes
Meningitis
Pink eye
Pneumonia
Pyorrhea
Ringworm
Shingles
Staph & Strep
Tortollids
Tuberculosis
...and 100's of others
No taste, smell, or sting!

**Kills bacteria on contact!
The BEST colloidal silver!**

Silver Solution™

A Total of 5 Fluid Ounces
\$29.95
(plus \$4 Shipping & Handling)
Visa, MC, Discover or AmEx accepted
C.O.D. available
Satisfaction Guaranteed Moneyback

FREE
With Your Order
1 oz Silver Solution™
in a pump spray bottle, \$9.95 value
Plus, FREE 18 page instructional booklet.
Offer ends soon!

4 OZ BOTTLE

1 oz spray

The concentration of silver particles in colloidal silver is expressed in PPM (parts per million). This is equivalent to the number of grams per liter of water.

- a. If this product reports that the silver concentration is 100 PPM, what is the molarity of this silver solution.

$$\frac{100g}{1L} \left(\frac{1mol Ag}{107.87g} \right) = 0.9mol/L$$

- b. How many grams of silver would be present in this 5 fl. oz. bottle of colloidal silver. 1 fl oz = 29.6mL

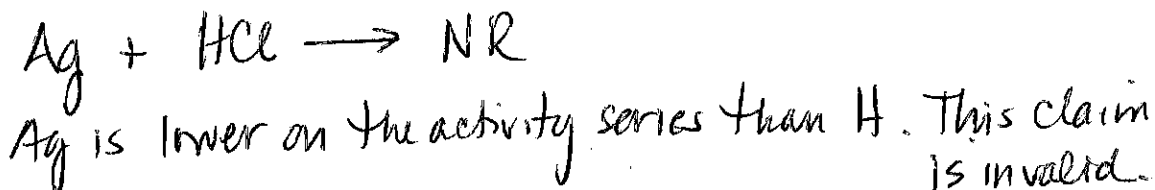
$$5 fl oz \left(\frac{29.6 mL}{1 fl oz} \right) \left(\frac{1L}{1000 mL} \right) \left(\frac{100g}{1L} \right) = 14.8g$$

- c. If the market price of silver is about \$23/ounce. Would the cost listed in the advertisement be reasonable? (1oz = 28.3g) Explain.

$$14.8g \left(\frac{1oz}{28.3g} \right) \left(\frac{\$23.00}{1oz} \right) = \$12.03$$

At a cost (retail) of \$29.95, this is no bargain

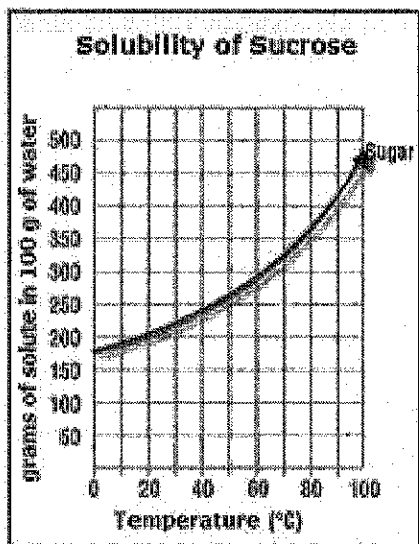
- d. One of the claims made by opponents of this remedy is that colloidal silver is neutralized by stomach acid, thereby rendering it ineffective. Write the equation for the reaction of silver with HCL and state whether this claim is valid or not.



- e. One of the side effects of colloidal silver is argyria. What is it?

gray to blue staining of the skin and mucous membranes produced by silver deposition after industrial exposure or as a result of taking medications containing silver or silver salts.

2. One recipe for rock candy requires that 450g of sucrose (table sugar) be dissolved in 150mL of water.



- a. At room temperature (about 25°C) would this mixture be unsaturated, saturated or super saturated?

Density of water is 1g/mL
 so 150mL = 150g

$$\frac{450g}{150g} = \frac{x}{100g} \quad x = 300g$$

← to match graph

- b. To what temperature would this solution have to be raised for all of the sugar to become dissolved?

~ 60°C

- c. If the temperature in saturated solution in (b) were rapidly cooled to 40°C, how many grams of sugar would come out of solution?

$$\frac{50g}{300} = \frac{x}{450}$$

x = 75g for a 450g sample

$$300 - 250 = 50g.$$

← @ 60°C @ 40°C

3. Hydrofluoric Acid is a weak acid that can have devastating effects on the human body upon exposure. When it ionizes in water, of which 60-70% of the human body is made of, fluorine ions are liberated. Fluorine ions are calcium "seekers", binding selectively to calcium which causes the demineralization of bones.

- a. Write the equations for the ionization of hydrofluoric acid in water (HINT: one of the products of this reaction is a hydronium ion)



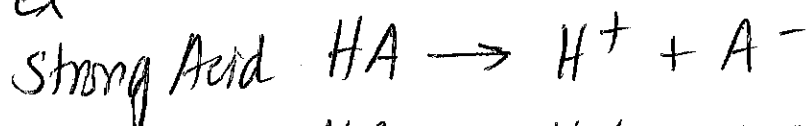
- b. What kind of acid is hydrofluoric acid, mono-, di- or tri-protic?

monoprotic (one Hydrogen)

- c. Define a weak acid in terms of dissociation.

A weak acid is one that does not completely ionize.

Ex



↳ only some of the acid ionizes
 therefore there are less H^+ ions in solution.

4. The relationship between acid rain and atmospheric pollution was first demonstrated by Robert Angus Smith in 1852. Acid rain is produced through a series of reactions that start with burning of fossil fuels. Write the 3 reactions that result in the formation of sulfuric acid given the following descriptions:

Step 1: When fossil fuels are burned, S combines with oxygen to form sulfur dioxide.



Step 2: Sulfur dioxide combines with water to make sulfurous acid.



Step 3: Sulfurous acid combines with oxygen in the atmosphere to form sulfuric acid.

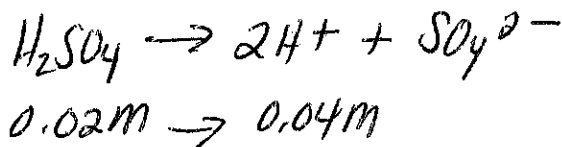


- a. To determine the concentration of sulfuric acid in acid rain, chemical climatologists can titrate acid rain with sodium hydroxide. If a 25.0 mL sample of acid rain was titrated with 10.0 mL of 0.1 M NaOH, what was the molarity of the sulfuric acid?

$$2NaOH + H_2SO_4 \rightarrow 2H_2O + Na_2SO_4$$

$$\frac{0.1 \text{ mol B}}{1 \text{ L}} \times \frac{0.01 \text{ L B}}{1} \times \frac{1 \text{ mol A}}{2 \text{ mol B}} \times \frac{1}{0.025 \text{ L A}} = 0.02 \text{ M } H_2SO_4$$

- b. If sulfuric acid were to completely ionize what would be the molar concentration of hydrogen ions?



- c. Given your answer to (b) calculate the pH of this sample of acid rain? (Remember, you only have 25.0 mL of rain, not a whole liter.)

$$pH = -\log [H^+] = -\log [0.04] = 1.4$$